(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 258 044**
A2

(12) # EUROPEAN PATENT APPLICATION

(21) Application number: 87307534.5

(22) Date of filing: 26.08.87

(51) Int. Cl.[4]: **B 64 F 1/305**

(30) Priority: 27.08.86 US 900850

(43) Date of publication of application:
02.03.88 Bulletin 88/09

(84) Designated Contracting States: FR IT

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(54) **Conduit for a passenger loading bridge.**

(57) A reversibly extensible loading bridge (2) for aircraft has an inboard end connected to a terminal (6) and an outboard end (8) adapted for connection to a parked aircraft. A heat exchanger (18) on the outboard end supplies warm or cold air to the aircraft. Hot or cold liquid is supplied to the outboard heat exchanger from a source at the terminal end of the bridge and extensible flexible supply (14) and return (16) lines convey the hot or cold glycol to or from the outboard heat exchanger. A means is provided for maintaining the supply (14) and return (16) lines under tension and to take up and give slack to the lines when the bridge is retracted or extended.

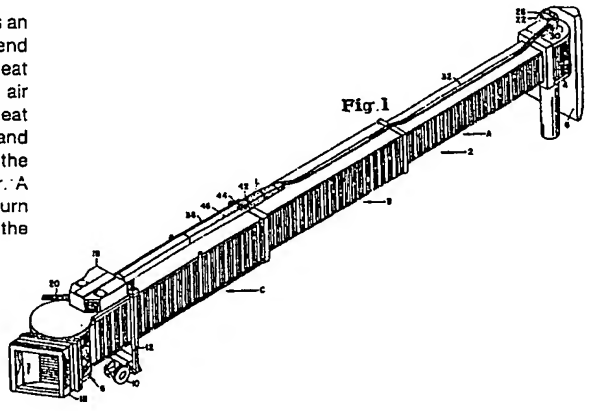

Fig.1

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Description

CONDUIT FOR A PASSENGER LOADING BRIDGE

The present invention relates to conduits for a passenger loading bridge.

Co-pending U.K. Patent Application No. 8627423 discloses an extensible loading bridge comprising telescoping tunnel sections which extend from a passenger terminal to a parked aircraft, and on which bridge is an extensible flexible carrier which accommodates flexible supply and return hoses which connect a source of hot or cold liquid at the terminal to a heat exchanger on the outboard end of the bridge. Hot or cold liquid, such as water or a mixture of water and glycol is fed through the supply hose and hot or cold air is blown from the heat exchanger to the aircraft. Other utility conduits such as electric power cables and communication lines are also housed in the carrier. The outer end of the flexible carrier terminates in a loop housed in an elongate hollow casing which extends lengthwise over the outermost tunnel section, the loop varying in length as the bridge extends or retracts, i.e.; when the bridge is extended the loop is short, and when the bridge is retracted the loop becomes long. The original embodiment of the invention provided the slack as needed for varying lengths of the bridge, but under certain conditions lengthwise opposing compression forces developed between opposite ends of the carrier, which forces tend to cause the carrier to hump or buckle.

It is an object of the present invention to provide a means for maintaining the flexible carrier and the conduits housed therein under tension so that it cannot hump or buckle.

In accordance with a first aspect of the present invention, there is provided a reversibly extensible bridge having an inner end connected to an aircraft terminal and an outer end adapted to be connectable to a parked aircraft, the bridge comprising a plurality of telescoping tunnel sections whose adjacent ends overlap to greater or lesser extents according to the extension or retraction of the bridge, and fluid transmission means comprising flexible hose means supported on the bridge and extending lengthwise thereof, means for anchoring inner end portions of the hose means to the innermost tunnel section and means for anchoring outer end portions of the hose means to the outermost tunnel section adjacent the inner end thereof, the outer end portions of the hose means extending from the points of anchorage thereof towards the outer end of the bridge and thence looping back towards the inner end of the bridge, the looped-backed portion of the hose means providing and taking up slack in the hose means in accordance with decrease and increase in the length of the bridge, characterised by tension means connected between one of the bridge sections and the hose means for maintaining the hose means under tension.

In accordance with a second aspect of the present invention, there is provided a reversibly extensible bridge comprising a plurality of overlapping tunnel sections for connecting an aircraft terminal to a parked aircraft, the length of overlap of the sections varying in accordance with variations in the total length of the bridge, a liquid transmission system comprising flexible hose means supported on the top of the birdge and running from the inboard end thereof to a point of anchorage on the inner end of the outermost tunnel section, means for connecting the hose means from the point of anchorage on the outermost tunnel section to the heat exchanger, the hose means having an outer end portion which extends outwardly from the point of anchorage thereof towards the outer end of the bridge, around a loop and thence back towards the inner end of the bridge, characterised by means for maintaining the hose means under tension comprising a take-up spool engaged in the loop, a cable connected to the spool and running therefrom towards the outer end of the bridge and thence around a pulley system supported on the outermost tunnel section and thence turning back to and around a pulley system supported on the inner end of the outermost tunnel section and thence back to a point of anchorage on the next innermost bridge section, whereby the length of the cable turning back thereof to the take-up spool varies in accordance with variations in the length of overlap of the bridge sections.

By way of example only, a specific embodiment of the present invention will now be described, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a typical passenger loading bridge with an embodiment of the present invention supported on the top thereof;

Fig. 2 is a fragmentary perspective view showing the inboard end of the bridge, the carrier and the supply and return hoses and power lines;

Fig. 3 is a perspective fragmentary view showing the carrier looped around the spool;

Fig. 4 is a fragmentary diagram illustrating the running of the cable to its anchorage on the next to the outermost bridge section;

Fig. 5 is a fragmentary perspective view showing the connection of the supply and return pipes with the heat exchanger;

Fig. 6 is a perspective view illustrating the cable tensioning means at the outboard end of the system;

Fig. 7 is a fragmentary perspective view, partly broken away, illustrating the supply and return line hose and pipe lines and the anchorage of the outboard end of the carrier; and

Figs. 8 and 9 are diagrammatic views showing the action of the cable system when the bridge is retracted (Fig. 8) and extended (Fig. 9).

Referring now to the drawings in which like reference numerals denote similar elements, the passenger loading bridge 2 comprises telescoping tunnel sections A,B and C. The inboard end of tunnel

A is mounted on a turret 4 supported on a terminal 6 and the outboard end 8 is supported on wheels 10 and may be raised and lowered by jacks 12 as needed to register with the door of an aircraft (not shown). It should be understood that there is a source of hot or cold liquid of conventional design (defined in the claims appended hereto as fluid-temperature modifying means) at the teminal which liquid is piped from the source via supply and return line hoses 14 and 16 (Fig. 2) which connect to a heat exchanger 18 adjacent the outboard end of the outermost tunnel section C and from which hot or cold air is blown via a large flexible tube 20 to a parked aircraft. In addition to the supply and return hoses there are power lines 22 and, if desired, communication cables (Fig. 5) which supply power and signals to the aircraft. Valves 24,26 are provided at the outboard end of the supply and return pipes 14A, 16A described further herein.

As best shown in Figs. 1 and 2, a box-like structure 30 provides anchorage for the inner end of a flexible carrier 32 which runs along the top of tunnel sections A and B, the outer end of the carrier being anchored at 34 to a transverse wall 35 of a hollow casing 36 which runs along the top of the outermost tunnel section C. The outer end portion of the flexible carrier 32 is looped back upon itself as indicated by the letter L and this looped-back portion provides or takes up the slack needed to accommodate the length of the carrier to the length of the bridge. As indicated in Fig. 7 the flexible carrier is supported on rollers 38 and 40 and on other rollers (not shown) as needed to support it on the tops of the tunnel sections A and B. As diagrammatically illustrated in Fig. 7 the outer end of flexible supply and return hoses 14 and 16 are coupled to rigid pipes 14A,16A which extend to the outer end of casing 36 where they are connected to a heat exchanger 18 (Fig. 5). The structure thus far described is essentially that disclosed in Co-pending Application No. 8627423. The present invention is as follows:

As shown best in Figs. 1 and 8-10, the loop L of the flexible carrier rolls around a spool 42 and the spool is connected by a yoke 44 to a cable 46. The cable extends outwardly through hollow casing 36 to a tensioning system (Fig. 6) consisting of an idler 48 under which the cable runs, the idler being mounted in a pivoted frame 50 which is pulled downwardly by tension springs 52. From beneath idler 48 cable 46 runs over a guide pulley 54 to a turn-around pulley 56 and thence over a guide pulley 58 to another spring-tensioning idler 60 whose supporting arms 62 are pulled downwardly by tensioning springs 64. From beneath idler 60 cable 46 runs over a guide pulley 66 and thence over pulleys 68 and 70 (Figs. 4,8 and 9) on the inner end of tunnel section C and thence outwardly to an anchorage 72 on the outer end of tunnel section B. As detailed in Fig. 4, the outer end of the cable passes through an eye 71 on top of the outer end portion of tunnel section B and thence to the anchorage 72. A turn buckle 74 may be used to tighten or loosen the cable as needed.

The operation of the cable system is best shown in the diagrams of Fig. 8 and Fig. 9. When the bridge is in retracted (Fig. 8) condition, and the looped-back portion L of the carrier is long so as to take up the slack, the outward movement of the point of anchorage 70 of the cable has moved outwardly so as to pull the spool 42 outwardly, thereby to maintain the flexible carrier 32 under tension. When the bridge extends (Fig. 9) the point of anchorage 72 of the cable end on tunnel section B has moved to its outer extremity, thereby permitting spool 42 to move inwardly (towards the terminal) thereby shortening the length of the loop L and consequently permitting the flexible carrier to assume its maximum length with respect to the bridge.

Several different types of flexible carriers are available on the open market, these carriers in general being formed of frame-like sections loosely joined to one another so that the carrier can turn aroound a 180° bend..

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

Claims

1. A reversibly extensible bridge having an inner end connected to an aircraft terminal (6) and an outer end adapted to be connectible to a parked aircraft, the bridge comprising a plurality of telescoping tunnel sections (A,B,C) whose adjacent ends overlap to greater or lesser extents according to the extension or retraction of the bridge, and fluid transmission means comprising flexible hose means (14,16) supported on the bridge and extending lengthwise thereof, means (30) for anchoring inner end portions of hose means to the innermost tunnel section (A) and means (34,35) for anchoring outer end portions of the hose means to the outermost tunnel section (C) adjacent the inner end thereof, the outer end portions of the hose means extending from the points of anchorage thereof towards the outer end of the bridge and thence looping the inner end of the bridge, the looped-backed portion (L) of the hose means providing and taking up slack in the hose means (14,16) in accordance with decrease and increase in the length of the bridge, characterised by tension means (48 to 72) connected between one of the bridge sections and the hose means for maintaining the hose means under tension.

2. A bridge as claimed in claim 1, wherein the means for maintaining tension comprises a take-up spool (42) around which the hose means (14,16) is looped, a cable (46) attached at one end to the take-up spool (42), means (72)

for attaching the other end of the cable (46) to one of the bridge sections (B), and yieldable means (52,64) for maintaining the cable under tension.

3. A bridge as claimed in claim 1 or claim 2, further comprising an elongate housing (36) on the outer end tunnel member (C), the looped-back portion (L) of the flexible tubes (14,16) being disposed within the housing, the liquid supply and return conduits including rigid pipe portions (14a,16a) disposed within the housing and having inner end portions connected to the flexible hose portions (14,16) of the liquid supply conduits.

4. A bridge as claimed in claim 3, wherein the housing (36) extends along the length of the outer end member (C) of the bridge and has an inner end portion overlapping the next adjacent bridge member (B).

5. A bridge as claimed in any of the preceding claims, further comprising a heat exchanger (18) on the outermost tunnel section (C), a fluid-temperature modifying means for supplying hot or cold liquid to the inner end of the bridge, fluid transmission means (14,16) for supplying the temperature-modified liquid to the heat exchanger, and means connecting the outer end portions of the hose means to the heat exchanger (18).

6. A bridge as claimed in claim 5 when appendent to claim 3 or claim 4, wherein the rigid pipe portions (14a,16a) have outer end portions connected to the heat exchanger (18).

7. A reversibly extensible bridge comprising a plurality of overlapping tunnel sections (A,B,C) for connecting an aircraft terminal (6) to a parked aircraft, the length of overlap of the sections varying in accordance with variations in the total length of the bridge, a liquid transmission system comprising a flexible hose means (14,16) supported on the top of the bridge and running from the inboard end thereof to a point of anchorage (34) on the inner end of the outermost tunnel section (C), means for connecting the hose means from the point of anchorage thereof on the outermost tunnel section to a heat exchanger, the hose means (14,16) having an outer end portion which extends outwardly from the point of anchorage (34) thereof towards the outer end of the bridge, around a loop (L) and thence back towards the inner end of the bridge, characterised by means (48 to 72) for maintaining the hose means (14,16) under tension comprising a take-up spool (42) engaged in the loop (L), a cable (46) connected to the spool and running therefrom towards the outer end of the bridge and thence around a pulley system (48,54,56) supported on the outermost tunnel section (C) and thence turning back to and around a pulley system (58,60,64) supported on the inner end of the outermost tunnel section (C) and thence back to a point of anchorage (72) on the next innermost bridge section (B), whereby the length of the cable turning back thereof to the take-up spool varies in accordance with variations in the length of overlap of the bridge sections.

8. A bridge as claimed in claim 7, the pulley system including spring-pulled idler pulley means (48) for taking up slack in the cable and for providing yieldable tensioning means therefor.

9. A bridge as claimed in claim 7 or claim 8, further comprising a source of temperature-modifying liquid at the inboard end of the innermost tunnel section (A), and a heat exchanger (18) on the outermost tunnel section (C), the liquid transmission system (14,16) supplying liquid to the heat exchanger (18).

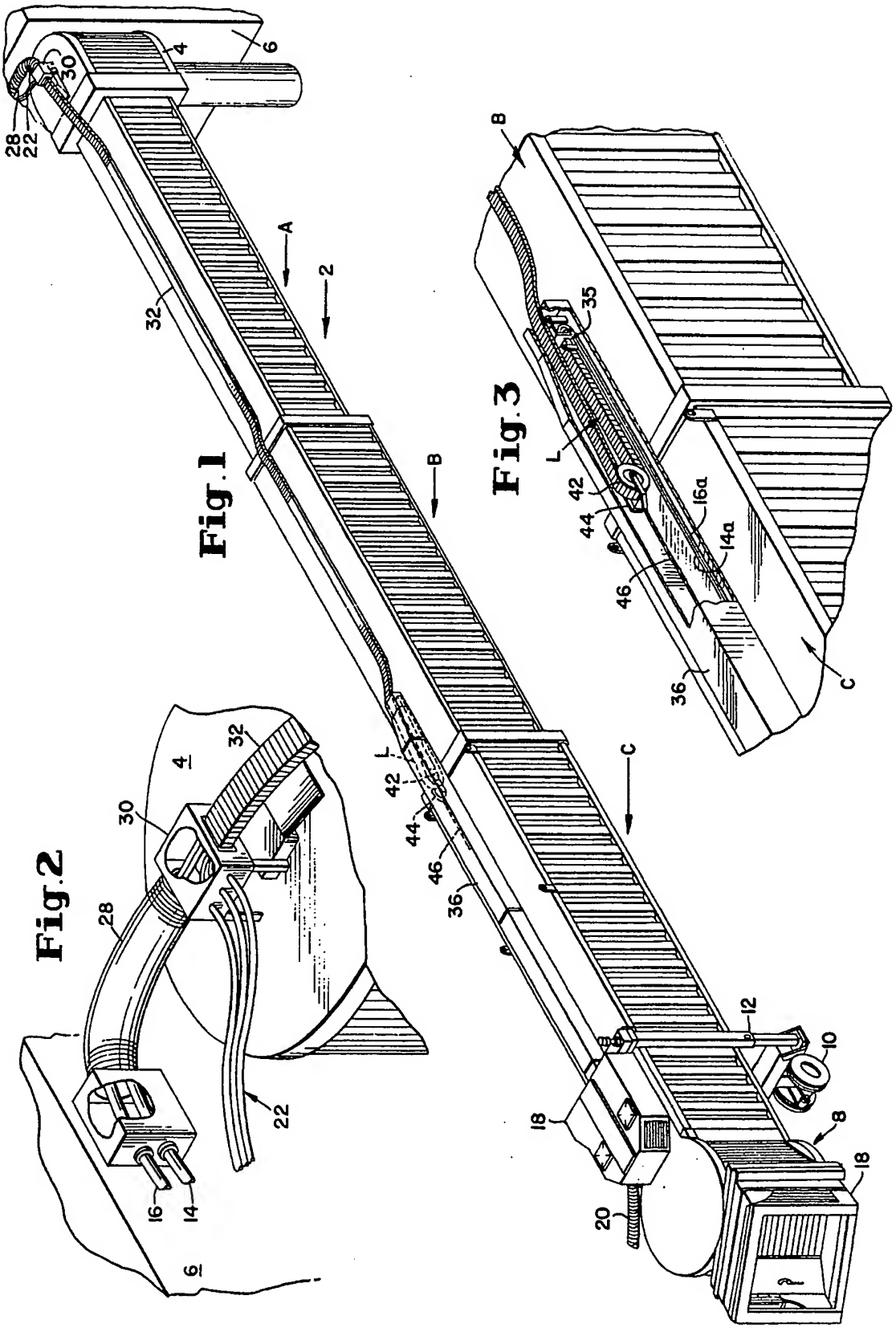

Fig.1

Fig.2

Fig.3

Fig.4

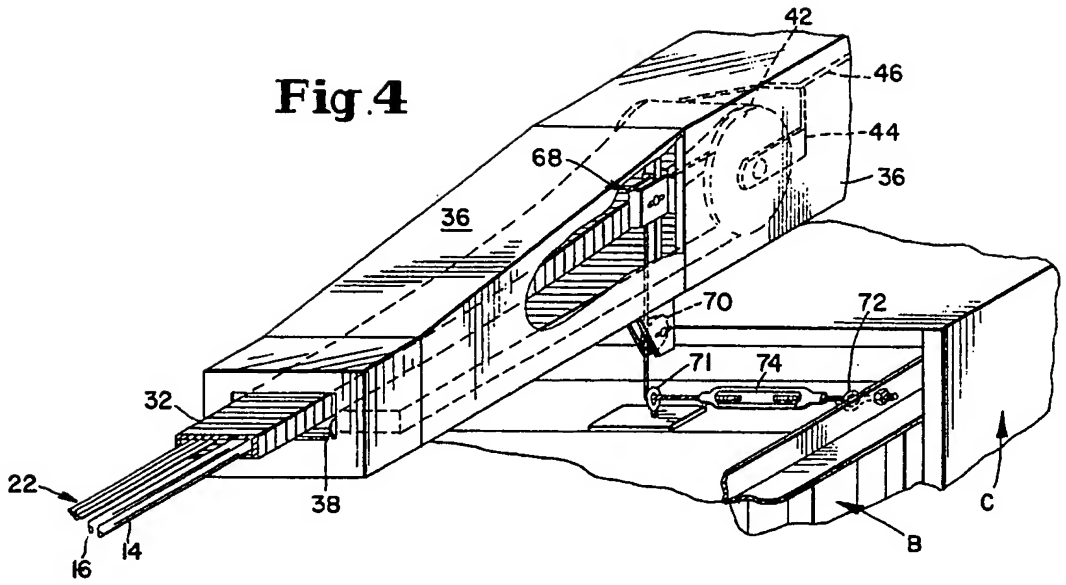
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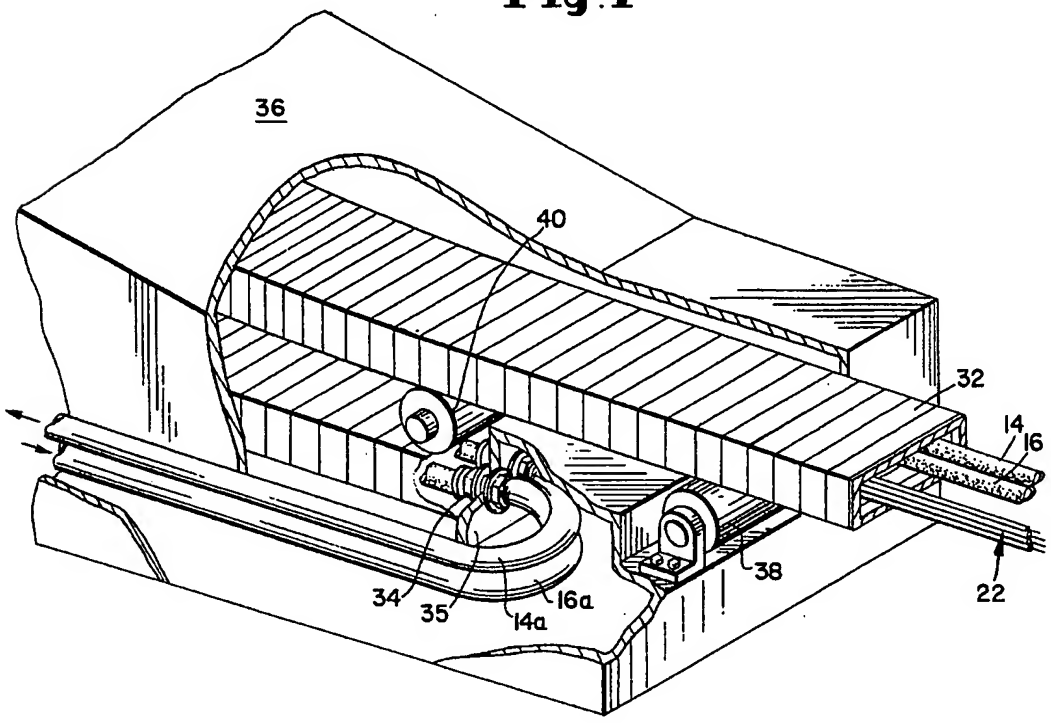
Fig.7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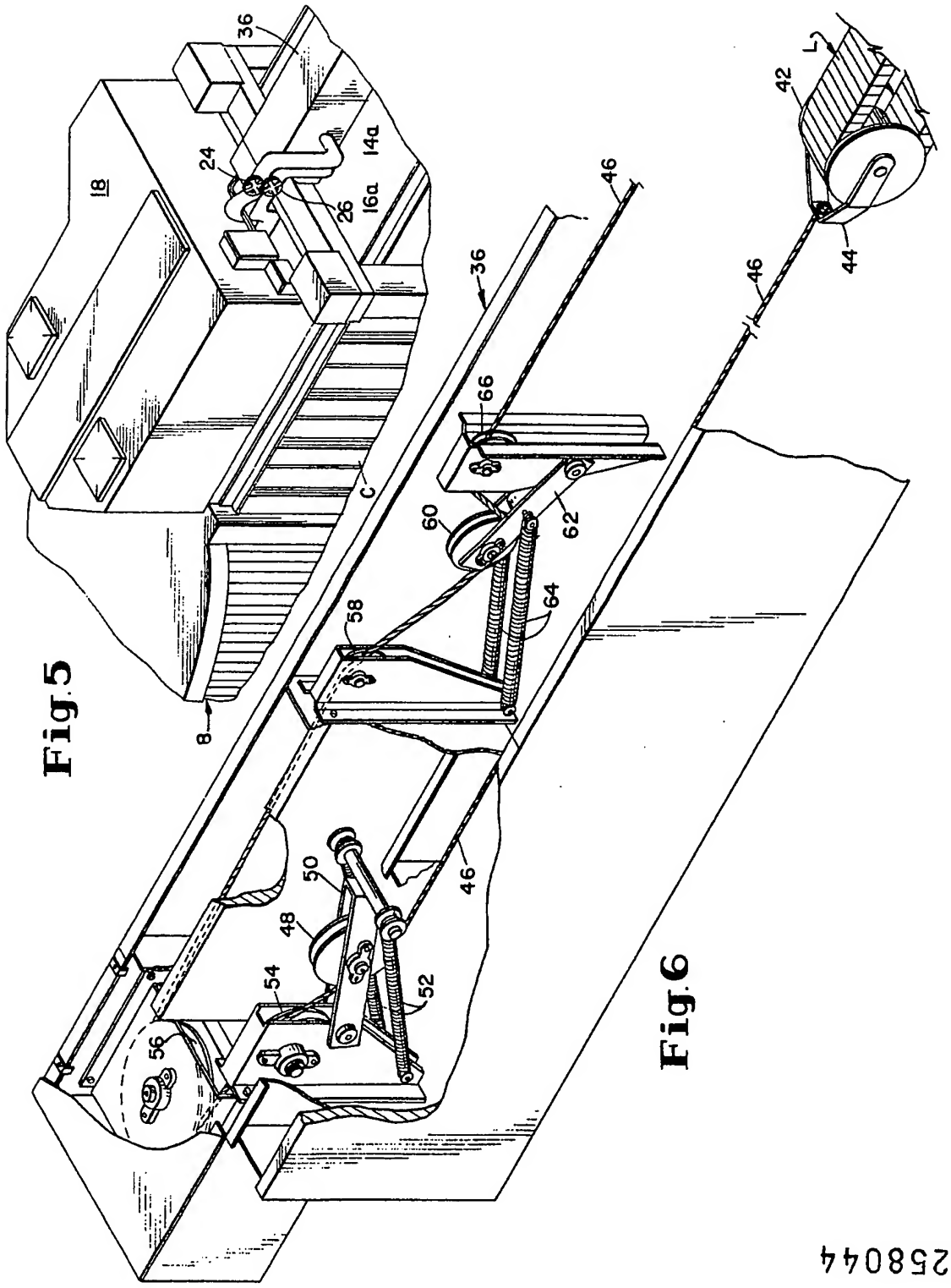

Fig.5

Fig.6

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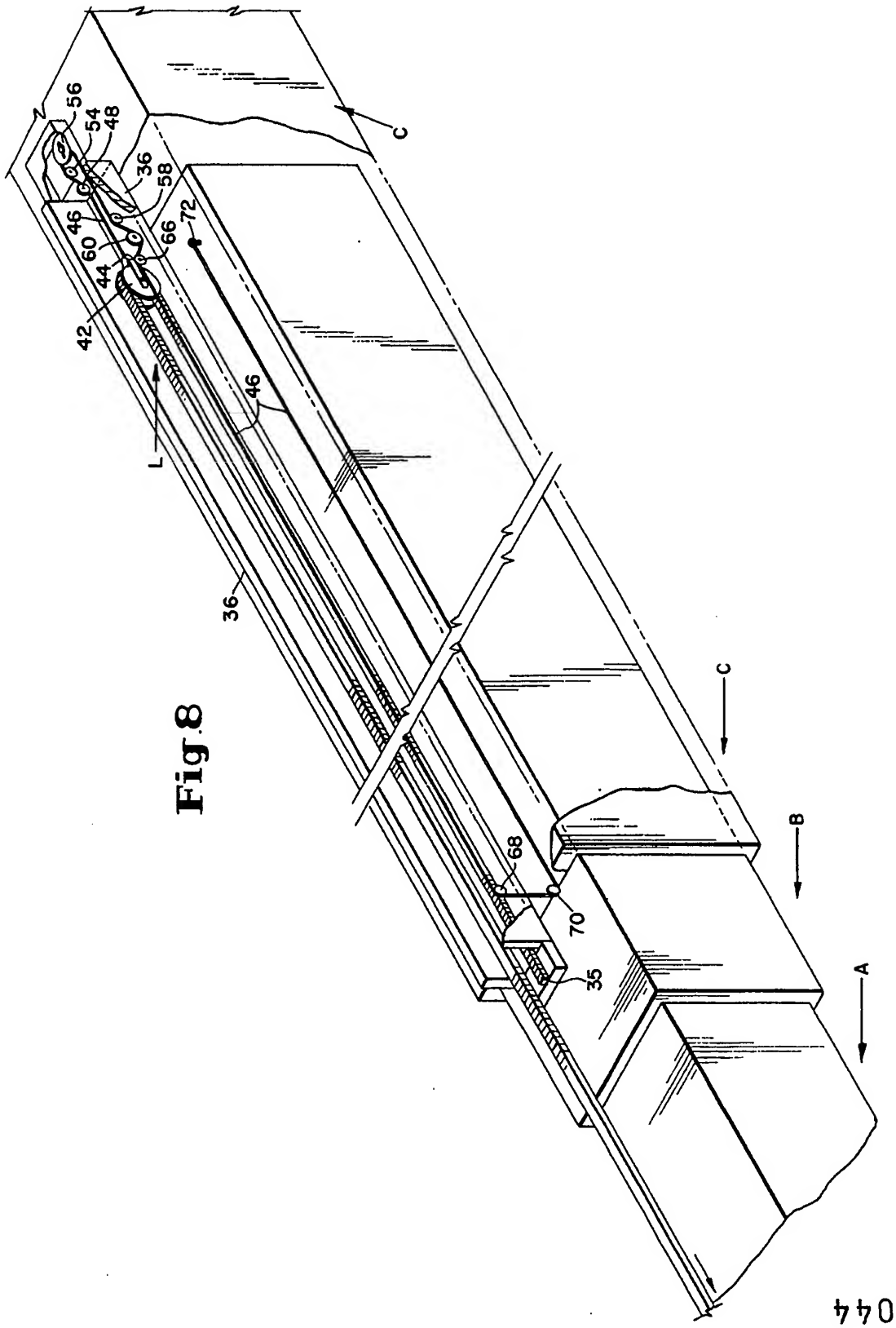

Fig.8

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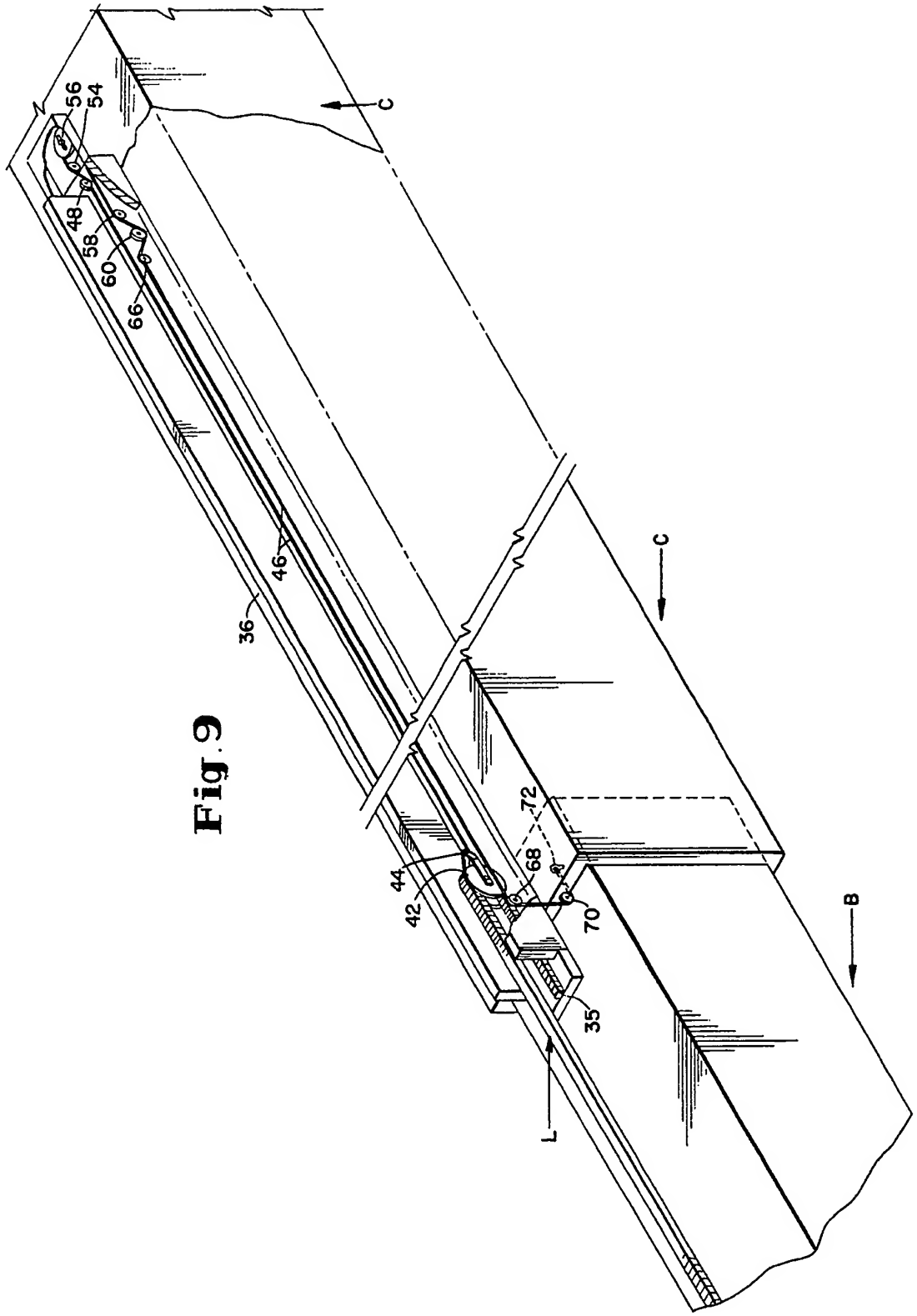

Fig.9